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SYNTHETIC FIBRES IN COLOMBIA*

Prepared by

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1. INTRODUCTION

The purpose of this paper is to give a concise idea on the synthetic fibres situation at the present, expectations and economic perspective for next years.

2. COLOMBIAN SITUATION IN CENTRAL AND SOUTH AMERICA

With regard to the synthetic fiber production in Colombia in comparison to the other countries located in central and south America, we could say that it is in the fourth position with excellent perspective of growing, as can be seen in table 1:

TABLE 1. C.A. AND S.A. SHYNTETIC FIBERS

PRODUCTION (EXCEPT OLEFINS

COUNTRY		NON CELLULOSICS THOUSAND TON/YEAR			CELLULOSICS THOUSAND TON/YEAR		
		1.982	83	84	1.982	83	84
1. México	Y	122	132	192	14	11	15
	S	115	131	172	5	5	10
	TOT	237	263	364	19	16	25
2. Brasil	Y	116	106	161	21	18	25
	S	82	80	111	24	22	31
	TOT	198	186	272	45	40	56
3. Argentina	Y	18	24	46	2	2	10
	S	12	16	30	--	--	10
	TOT	30	40	76	2	2	20
4. Colombia	Y	26	28	45	2	2	4
	S	12	12	15	--	--	--
	TOT	38	40	60	2	2	4
5. Perú	Y	10	12	16	1	1	2
	S	29	29	33	--	--	--
	TOT	39	41	49	1	1	2
6. Venezuela	Y	8	10	12	1	1	2
	S	4	4	8	--	--	--
	TOT	12	14	20	1	1	2

Y = YARN, S = STAPLE, TOT = TOTAL

From table 1 it can be easily deduced that the greatest growth was in 1984, the main growth being for Argentina (90%), followed by Colombia (50%), Brazil (46%) and México (38%). Definitely, 1984 was "the year" of synthetic fibres for American countries.

3. TEXTILE INDUSTRY IN COLOMBIA

We can describe the year of 1984 as the most positive and growth year of the 80^{ies} for the textile industry. Respecting 1983, there was a 12% growth in textile production during 1984.

Although there still are many troubles to solve such as the big external debt (12 billion dollars), unemployment (15%), financial loans etc, there are positive signs that let us realize what expect:

To become into an industrialized country.

The three main man made fibers in Colombia worked at full capacity during 1984, and the reached 17% more production that in 1983.

In polyester, the sales grew 11%, and almost 50.000 tons were produced as yarn and staple.

Enka, the major company, raised its nylon chips production up to 8.500 ton (8% more), and also increased the polyester chips production to 16.000 tons (6% more than in 1983); the problem still is the poor installed capacity because we have to buy to México and Venezuela 14.000 tons per year of polyester chips.

In general the three man made fiber factories in Colombia are not able to produce what the local market needs, and the government does not allow to enter imports fabrics or clothes, so it is the best time for the national industry to grow as much as the market asks for. For instance, 10.000 tons of polyester staple were produced in 1984, but we still had to buy 5.000 tons to united states.

4. SYNTHETIC FIBERS PRODUCERS IN COLUMBIA

There are only 5 factories in Colombia which produce synthetic fibers for textile consumer and they cannot supply all what the market needs. See table 2:

TABLE 2. SYNTHETIC FIBERS PLANTS IN COLOMBIA

NAME	PRODUCTS	TON/YEAR
Enka de Colombia	Nylon 6 chips	8.500
	Nylon 6 tire cord	5.100
	Nylon 6 text.yarns	2.000
	Polyester chips	15.500
	Polyester yarns	10.900
	Polyester staple	5.400
Quintex (Called Celanese two years ago)	Acetate	4.000
	Nylon 6 chips	6.000
	Nylon 6 yarns	5.000
	Polyester chips	3.000
	Polyester yarns	6.400
	Polyester staple	2.000
Polimeros Colombianos	Polyester yarns	5.500
	Polyester staple	3.500
Vanylon	Nylon 6	Unknown
Zylette (Lafayette)	Polyester yarns	2.000

There are others plants which produce olefin film and olefin BCF yarns for carpets: Monofil, Ciplas, compania Nacional de Empaques and Polymer de Colombia.

In Colombia we only produce acetate, nylon 6 and polyester fibers. We have to buy to other countries: viscose, acrylic, nylon 66, etc.

5. PROJECTS

Enka and Polimeros Colombianos have quite important projects to be started in 1985.

Enka is going to expand its polyester chip plant from 15.000 ton/year up to 32.000 ton/year in order to not to have to buy it abroad.

Polimeros Colombianos will open a polyester chip plant at the end of 1986, with a capacity of 10.000 ton/year.

Also Polimeros Colombianos will expand its polyester staple plant from 4.000 ton/year up to 10.000 ton/year.

Those are the main projects.

6. CONCLUSION

The main problem in our country Colombia is that we have to expend more money (Dollars) buying imports products than the money we get from exports, and in spite of the government restrictions to imports goods we have to buy from abroad synthetic fibers that we could be producing in our country, so there should be many projects in this field and the perspectives are excellent.

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SYNTHETIC FIBRE INDUSTRY IN TURKEY*

Prepared by

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** Petkim Petrochemical Co. Yarimca Complex

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INTRODUCTION

Since early sixties, synthetic fibre industry has grown up rapidly in Turkey. For a long time conventional naturel fibres were used in textile industry. In the mid of the fifties, rayon, the cellulosic fibre appeared. Eventhough its raw material had been wood and cotton cellulose, this was the first synthetic fibre in our domestic market. It was called "Artificial Silk".

In sixties, the synthetic fibre which was produced from petrochemical raw materials was begun to be used in textile industry and each year the synthetic fibre usage has increased.

Nowadays, textile products takes an important place in Turkey's export potential. It means that the synthetic fibre industry will keep its importancy in the future.

SYNTHETIC FIBRES

In the synthetic fibre industry of Turkey there are mainly for different kind of fibres use.

They are;

a) Cellulosic fibre,

b) Polyamide fibre,

c) Acrylic fibre,

d) Polyester fibre,

CELLULOSIC FIBRE

Cellulosic fibre is practically different from other synthetic fibres. The raw material which is used for producing fibre is cellulose. As it is known cellulose is obtained naturally. Also cellulose itself can't be used as fibre. Some chemical reactions take place for in producing fibre. This cellulosic fibre is called artificial silk in domestic appliance.

Sümerbank, the state company owned a cellulosic fiber plant. After extensions the capacity of this plant is approxiametely 6000 tons/year.

∝ cellulose, the raw material is imported mainly from Finland and Sweden.

The reaction of an alkali cellulose with carbon disulfide to form cellulose xanthate (the cellulose monoester of unstable dithiocarbonic acid, H_2COS_2) forms the basis of the viscose process industry.

Chemically, the reaction is a heterogeneous esterification of the hydroxyl groups of an alkali cellulose by carbon disulfide in vapor form. The resulting xanthate will dissolve smoothly in dilute alkali to form a viscose spinning solution of good filterability. Viscose in turn, yields regenerated cellulose fibres into an acid coagulating and regenerating bath.

The product rayon fibre is called commonly "artificial silk" in our country. Rayon fibres is mixed to a some degree with natural fibres in textile industry.

POLYAMIDE FIBRES

Polyamide type of synthetic fibres are produced wholly by private companies.

Filament Sentetik A.Ş. owned a Nylon 6,6 fibre plant. It's capacity is approximately 5000 tons/year. By 1985 the plant's capacity will increase to 15000 tons/year. The company uses Zimmer licence.

For producing Nylon 6,6 , the raw material is imported, because there is no domestic production.

Polyamides of this kind are widely used as textile fibers for wearing apparel, as cord for reinforcement of heavy-duty tires.

SIFAŞ, INSA and TEKSTIPLIK private companies involve with the production of Nylon 6 or polycaprolactam.

Sifaş has 10000 tons/year production capacity, Insa has 6000 tons/year and Tekstiplik Co. has 4000 tons/year production capacity.

There are several satisfactory commercial ways to produce polycaprolactam. (Nylon 6). In one method, ε- aminocapronic acid is used as catalyst. Molten caprolactam with 1-5 percent catalyst is heated at atmospheric pressure at 240-280 ^{o}C for 6-8 hours. In another method an aqueous solution of caprolactam is heated under pressure in an autoclave. No catalyst is used since some hydrolys takes place to produce aminocapronic acid.

One method makes use of alkali-metal catalyst under anhydrous conditions. Molten caprolactam polymerizes very rapidly in the presence of sodium or lithium catalyst.

Polycaprolactam (melting point 215 ^{o}C) is melt spun into filaments.

For producing Nylon 6, caprolactam is used as raw material. In Turkey caprolactam is produced by Petkim Petrochemical Co. Petkim is a State Company. Petkim has two complexes. One is located in Yarımca/Kocaeli and another is in Aliağa/Izmir.

In Yarımca complex, there is a caprolactam plants group. This group consists 5 different plants. The caprolactam production capacity is 25000 tons/year. The licences of these 5 plants are belong to Inventa Ems and Ube. These 5 plants are as follows;

a) Cyclohexane plant,

b) Cyclohexanone plant,

c) Oleum/SO_2 plant,

d) Caprolactam plant,

e) $(NH_4)_2SO_4$ plant,

The raw materials for this process benzene, ammonia, elementel sulphure and naphta. All these raw materials are supplied domestically.

In cyclohexane plant, naphta is used for producing H_2 and CO_2. In this plant benzene has converted to cyclohexane by hydrogenation in the presence of Nickel catalyst.

Cyclohexane is oxidised by air directly after some reaction stages, and cyclohexanone is produced.

Lactam plant has different units. Ammonia, SO_2 and cyclohexanone are used in chemical reactions for producing lactam. SO_2 is supplied from Oleum/SO_2 plant. For producing SO_2, elementel sulphure is burned. The final product, caprolactam is filled to polyethylene bags as flakes.

$(NH_4)_2SO_4$ solution which is derived from lactam plant is sent to $(NH_4)_2SO_4$ plant. With a vaporisation process concentrated $(NH_4)_2SO_4$ is produced and sold as fertilizer.

Production of caprolactam monomer is as follows,

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984
Tons	5278	14479	13216	16448	14886	14433	18991	9414	8952

In textile industry 50 per cent of Nylon 6 is used for producing muss nylon. After texturizing process Nylon 6 is converted to muss nylon. Muss nylon is used especialy for manufacturing of socks and stockings. Nylon 6 fibre is also used for manufacturing clothings, carpet and blankets.

ACRYLIC FIBRES

Acrylic fibre production is achieved by two private companies. AKSA and Yalova Akrilik A.Ş.

The raw material ACN polymerised by various techniques. ACN is a stable monomer exhibiting little tendency toward purely thermal polinerization, but it can be polymerized readily using catalysts or various types of radiation. Peroxides have been used to initiate the free radical polymerization of acrylonitrile.

Acrylic fibers are spun from solvents, either by direct evaporation or by use of a coagulating bath. Principal uses are in suits and other woven fabrics, in jersey knit goods, in sweaters and in blankets. Acrylic have outstanding resistance to sunlight, insects, and chemicals. They have high sticking temparatures, warm feel, good dimensional stability, and low moisture absorbtion. They can be used alone, as in sweaters, but are often blended with wool or with rayon.

Because there is no domestic ACN production yet, the whole ACN demand is inported.

AKSA and Yalova Akrilik A.Ş. has started-up their plants in mid seventies. ACN consumption for producing acrylic fibre of bath plants are as follows.

1976	28000	tons
1977	38000	"
1980	44000	"
1984	57000	"

82000 tons of demand would be expected in the year 1987.

In Petkim Aliağa/İzmir Complex a new ACN plant will be on stream very soon.It has 70000 tons/year capacity. ACN will be produced by Sohio process. Propylene and ammonia are oxidised by air in the presence of catalyst. This reaction is called ammoxidation.

Raw materials, propylene and ammonia will be supplied domestically.

Turkey's ACN demand prediction is as follows,

1986	79300	tons
1987	87700	"
1988	96500	"
1989	105700	"
1990	115400	"

POLYESTER FIBRES

Polyester fibre can be produced from dimethylterephatlate and pure terephtalic acid. Because there were some technological difficulties for producing PTA, DMT is seemed prefferable raw material in textile industry. But in last 10 - 15 years, new developments were obtained in production technology of PTA, and it had won its place as a raw material for synthetic fibre industry.

In Aliağa Petrochemical complex a new pure terephtalic acid plant will be on stream soon.

It has 70000 tons/year capacity and Amoco licence is chosen for this plants

P.xylene is used as raw material for Amoco process. P.xylene is oxidised to terephtalic acid directly in the presence of NaBr. Cobalt and Manganase acetates are used as catalysts for the reaction.

SANCAK Tül is a private company that uses TPA for producing polyester fibre.Dimethylterephatlate is the most important raw material for producing polyester fibre.

DMT is produced by a private company SASA. After its extention, SASA has 120000 tons/year capacity. DMT is produced by Dynamit Nobel process.

The feed for the process, p.xylene is imported, but very soon in Petkim Aliağa Complex P.xylene will be produced from aromatic extraction plant.

P.xylene, in the presence of heavy metal catalysts oxidised by air to P.toluic acid and monomethylterephtalat. Then these acids oxidised to P.methyltoluate and DMT.

DMT polycondansated and polyester fibre is produced.

SASA, also has synthetic fibre facilities. Its capacity is approxiametely 80000 tons/year and Dupont process is used.

DMT consumption figures are as follows.

Years	1976	1977	1978	1979	1980	1981	1982
Cosumption	42781	53427	59232	66195	69796	79689	89855

Both DMT and TPA originated synthetic fibres have a big potential in domestic market and for export.

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THE DEVELOPMENT OF THE MAN-MADE FIBRES MANUFACTURED IN INDONESIA*

prepared by

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P R E F A C E

This paper explains some general views about the development of synthetic fibres and their consumption in Indonesia since the first Five Year Development Plan (FYDP 1969-1983) up to the projection for the fourth FYDP (1984-1988).

The list of the synthetic fibre manufacturers are also presented including the problems to cope in order to produce a better product for the end of the fourth FYDP (1988).

Many institutions and private sectors who have been involved in the research and development of synthetic and natural polymers have been mentioned briefly.

Finally, this paper also mentions about the activities having been carried out by the Institute For Research And Development Of Textile Industries and its need for an International Aid.

This paper will be presented in the International Conference Of Synthetic Fibre in BEIJING, on Novembre 18 - 22,1985.

FIBRE CONSUMPTION

It was in 1969 when the Indonesian Government started with its first "Five Year Development Plan" (1rst-FYDP). The main program at that period was mainly to supply enough food and cloth for the whole people, of about 120 millions habitant with 2.1 per cent rate of birth, in an ambient of stable governmental arrangement.

As a starting point of industrialization the Indonesian enterprises have built, among others, many textile mills, more modern than before especially in spinning, weaving and finishing. By the end of the first FYDP (1973), the textile industry had developed very rapidly , especially for the products from cotton fibres . However, the textile consumption showed a gradual rising demand for synthetic fibre following the world textile consumption and trend .

Then, on the 2nd-FYDP from 1974 up to 1978 the Government has encouraged the fibre manufacturers to produce synthetic fibre by inviting foreign capital and transferring technology in textile processes, including knitting and carpet . Besides, since the early seventieth , many experts from other countries have been invited to assist the textile industries in dealing with the new technology concerning the synthetic fibre processes especially for dyeing and finishing.

These activities have reached a tremendous progress with the international aid from UNIDO/UNDP and the collaboration of the Institute Of Textile Technology in Bandung, representing the Department of Industry,which acted as counterparts for the experts from Egypt, England, India, Japan,Belgium and from other countries organized by the UNIDO/UNDP.Belateral Co operation was also held with other countries such as Dutch, Germany and France.

By the second year of the 2nd-FYDP (1975) the small products of polyester staple fibre and polyamide filament yarn appeared in the market only about 23% from the whole consumption (68278 tons). By the end of this second term,synthetic fibre production reached 65% of the whole synthetic fibre consumption in Indonesia (102,516 tons).

For the 3rd-FYDP (1979-1983) the production of the synthetic fibres increased from 72,981 tons (52.63%) up to 152,559 tons (83.25%).This increase was especially supported by the production of viscose rayon staple which was just started in 1982 . Of course, the synthetic fibre consumption (188,955 tons) was just a part of the whole textile consumption which was about 469,440 tons by the end of the 3rd-FYDP . The difference was laid on the use of 280,485 tons fibres consists of some natural fibres such as cotton (130,000 tons) , silk, wool, and some other synthetic fibres like acrylic and olefin fibre .

Along with the following five year development plan (1984 - 1988) or the 4th-FYDP, the Government has projected almost equal amount of the textile consumption per capita (± 13 m). Judging from that plan coupled with the rate of the population growth of about 2.1%, the Indonesian's habitant will be about 176 millions by the year 1988. Then, the textile consumption will cover 476,688 tons, excluding the textile production for export and import .

According to the latest data (1,2,3,4,5) the projection for the main textile material will be 416,000 tons by the end of the 4th-FYDP, which contains cotton, polyester staple, polyester filament, cellulose rayon and polyamide. While the deficiency of about 60,688 tons will be probably fulfilled by some other fibre such as wool, silk, olefin, ramie, jute,etc. Comparing with the composition of fibre demand in the market for the year 1977 and 1984 as presented in the Table 1 with the projecting demand for the year 1988, the position of the fibre consumption does not change much between 1984 and 1988, with the main demand for cotton , polyester and cellulose rayon. While for the year 1977 from the second FYDP, the demand was also in the order of cotton and polyester followed by cellulose, but the fibre composition was slightly different in term of percentage.

It seems that the demand for polyamide and acrylic fibre does not increase much, since those two fibres were mainly

TABLE 1

THE COMPOSITION OF THE FIBRE DEMAND
IN THE MARKET ⁻⁻)

Type Of Fibre	Fibre Composition (%) For The Year :		
	1977	1984	1988
Cotton	37.59	31.01	33.35
Polyester	34.57	29.82	32.31
Cellulose Rayon	9.35	12.17	13.22
Acrylic	0.96	4.77	5.24
Polyamide	4.16	2.86	3.15
Other Fibres	13.37	19.37	12.73
TOTAL (%)	100.00	100.00	100.00
FABRIC (tons)	212,430	419,190	476,688
Consumption/cpt	9 m	12.97 m	13.55 m
Calculated total fibre consumption (tons) ⁻)	233,673	461,109	524,357

⁻⁻) This data was recalculated from the sources (5,6,7)

Note: ⁻) Average waste in spinning and weaving 10%
1 metre fabric weighs 200 grams .

used for carpet and some hosiery fabrics due to the lack of some properties which is suitable for apparel material. The demand for cotton, polyester and rayon remains almost constant in term of percentage. As a tropical country Indonesia does not need such a heavy clothing, consequently cotton, rayon and their blends with polyester will be chosen for apparel material. Polyester and rayon are also used as home furnishing and industrial fabric along with the other synthetic fibres like polyamide, acrylic, olefin and acetate .

If the average waste in spinning and weaving process equals to 10 % and one metre fabric weighs 200 grams, the total fibre consumption will be 524,357 tons by the end of the fourth five year development plan in 1988. The consumption of the synthetic fibre calculated from the fibre composition as mentioned in the Table 1 , will be about 282,733 tons with domestic production of about 85 % or 240,323 tons .

SYNTHETIC FIBRE MANUFACTURER

To meet the demand for the fibre and textile consumption by the end of the fourth FYDP, some preparation must be accomplished either by the Government or the private enterprises. Up to June 1984, there were already 15 companies or institutions listed as the synthetic fibre manufacturers, as presented in the following Table 2 .

Most of the companies are cooperating with foreign capitals from Japan, Korea, and India or sharing with other private companies in Indonesia.

TABLE 2

THE LIST OF THE
SYNTHETIC FIBRE MANUFACTURERS IN INDONESIA (3)

No.	Name Of The Company	Type Of Production	Location
1.	Institute for R&D of Cellulose Indust	Viscose rayon (filament& staple)	Bandung, West Java (pilot plant)
2.	PT.Indo Barat Rayon	Viscose rayon (staple)	Desa Cilangkap,Purwakarta, West Java
3.	PT.South Pacific Viscose	Viscose rayon (staple)	Purwakarta, West Java
4.	PT. Indonesia Asahi Chemical	Nylon 6 (filament)	Jatiluhur,Purwakarta, West Java
5.	PT.Indonesia Toray Synthetics	Nylon 6 (filament) Polyester (staple)	Tangerang, West Java
6.	PT.Industri Sandang I	Polyester (staple)	Tangerang, West Java ^^
7.	PT.Kuma Fiber (Kurary Manunggal Fibre Industries)	Polyester (staple)	Cikokol, Tangerang , West Java
8.	PT.Shinta Indah Djaya	Nylon 6 (filament)	Tangerang, West Java
9.	PT.Susila Indah Synthetic	Polyester (filament)	Tangerang,West Java
10.	PT.Tifico (Teijin Industry Fibre Corp)	Polyester (filament and staple)	Tangerang, West Java
11.	PT.Tolaram	Polyester (filament)	Tangerang,West Java
12.	PT.Tri Rempoa Solo Synthetic	Polyester (staple)	Tangerang, West Java
13.	PT. Yasinta	Polyester (staple)	Tangerang, West Java
14.	PT.Texmaco Taman Synthetic	Polyester (filament)	Kaliwungu-Kendal, Central Java
15.	PT.Industri Sandang II	Polyester (filament) Viscose rayon (stp)	South Sumatra ^^ West Kalimantan ^^

^^ in preparation

The kinds of fibres produced in Indonesia are mainly regular fibres. As the future market demand does not only fulfil the textile need, without thinking of comfort like what has happened in the last decade, the production for modified fibre or new textile material which is suitable for tropical country has to be considered .

Accordingly the modified fibres (such as cationic or anionic dyeable polyester with high moisture regain, high modulus and high resilience viscose rayon fibre, high melting point with low elongation polyamide fibre, etc.) should be produced along with the regular fibre. Modified polypropylene with high dyeability, high moisture regain and high melting point with high resistant to photo oxydation, can be considered as the new textile material.

RESEARCH AND DEVELOPMENT

Many institutions have put their interest on polymer research and development since the beginning of the second FYDP or since the early seventieth. These activities have been started by the foundation of the Indonesian Polymer Association with the membership from many institutions and private sectors. Some seminars and symposiums were held by this association either in Bandung or in Jakarta. Some important meetings about synthetic fibre and polymer research and development in foreign countries like Japan, Sweden, Singapore, Canada, France, U.S.A. , England Thailand, etc. were also attended by the Indonesian scientists or industrialists .

Among the institutions which have involved in the research and development (R&D) for synthetic and natural polymers are :

-Institute for Research and Debelopment (IRD) of Textile Industries)IRDTI), Cellulose Industries (IRDCI), Chemical Industries (IRDCHI), Batik and Handicraft Industries (IRDBHI), Leather and Plastic Industries (IRDLPI). These IRD are organized by the Department of Industry through The Agency for R&D of Industries (ARDI).

-IRD of Rubber Industries organized by the Department of Agriculture and Plantation.

-Institute Sciences of Indonesia (LIPI) .

-Centre Application of Isotops and Radiations (PAIR) which is organized by the National Atomic Energy Agency (BATAN).

-Bandung Institute of Technology organized by the Depart - ment of Education.

-Indonesian Petroleum Company (PERTAMINA) and IRD of Oil & Gas (LEMIGAS) organized by the Department of Mining and Energy.

-Agency for Controlling and Testing of Technology (BPPT) .

-Association of Indonesian Synthetic Fibre Manufacturers (APSYFI).

-Indonesian Polymer Association , and other private sectors and industrialists.

Since each R&D in synthetic fibres and polymers will also involve with the ability of the researchers and industries to find enough chemicals and monomers in the market without any problem and difficulty, then, it is a challenge for the Government through its R&D in the chemical industries, to cope with the problems. They have to be able to create a suitable environment for encouraging the private sectors to increase and to inprove the products in the up-stream industries such as the aromatic and petro-chemical industries in producing the monomers, catalysts, solvents, etc.

INSTITUTE FOR R&D OF TEXTILE INDUSTRIES

IRDTI or the former Institute of Textile Technology in cooperating with the Centre Application of Isotops and Radiations have been doing some research on modification of textile fibres by means of radiation induced graft polymerization. The research was merely focused on the modification of the polypropylene and polyester fibres for their hydrophylization. This method was also applied on the cellulose fibre to gain some properties in crease resistant and dimensional stability to substitute the convensional process with resin finish.

IRDTI has also been experimenting the synthese of the resins to be used as binder in pigment printing and resin finishing on various fibres by means of emulsion polymerization. Some modifications have also been done on cotton and its blend with polyester fibre to improve their crease resistant, dimen-

sional stability and dyeability to cationic dyes by means of etherification process. Chemical modification of the polypropylene and polyester fibre was also carried out in the radical polymerization using chemical initiation and catalytic modification.

In the case of testing and standardization, the IRDTI maintaines a cooperation with the APSYFI to organize standard specifications in testing the fibre quality. In dealing with the industries and maintaining the cooperation among the Asean countries with IRDTI as the Asean Fibre Testing Centre has organized many courses in cotton classification, technical quality control in spinning and up grading the spinning supervisor in management. A short and long term courses in textile technology was also given to the participants from other countries like Papua New Guinea, Malawi, Sinegal, Tanzania, Sri Lanka, etc.

Some research cooperation with other foreign institutions have also been taken place between IRDTI with the :

-Research Institute for Polymers and Textiles (RIPT),Tsukuba, Japan.

-Government Industrial Research Institute Osaka (GIRIO), Osaka, Japan.

-Centre Studies on Application of Isotops and Radiations (CEN) de Saclay, France.

-Centre Research of Technology (TNO), Delft, Holland.

INTERNATIONAL AID

Since most of the research cooperation have been involved only in the exchange researchers without having any international aid for the laboratory equipment especially for polymer synthesis and analysis, the IRDTI has faced some problems in keeping up with the latest technology in the field of synthetic fibres and resin productions .

This unfavourable condition has been the main cause for having a rather big gap between IRDTI with the textile industries especially with the synthetic fibre manufacturers.
Although the IRDTI does not have any direct relation with the research and development in the up stream industries for producing monomers and catalysts, the IRDTI pays a great attention on their production and quality.

The IRDTI can support the industries by organizing training courses and quality control in the field of fibre processing and testing, including the research and development in improving the fibre properties. If all the research products in modifying, synthesizing the fibres and polymers done by the IRDTI can be applied in the bigger scale such as in pilot scale, it will be just one more step for the application in the industries.

This consideration must be taken into account on the basis of ameliorating the fibre and resin properties, in order to fulfil a better product for the textile consumption by the

end of the 4th five year development plan in 1988.

Judging from the past that the development of the textile industries in Indonesia has been improved rapidly by international aid especially by the UNIDO/UNDP and some foreign capitals, it will be more complete and perfect if some more international aids could be given to our Institute through the Department of Industry- c.q. the Agency for R&D of Industries.

With adequate aid the Institute will be able to run for the R&D of textile industries and giving some assistances to the synthetic fibre manufacturers as the fibre research and testing centre. The IRDTI will be able to improve some activities in the synthesizing, analysing and modifying the textile fibres and resin finish polymer in the pilot scale . So that the final result can be developed and applied in the industrial scale with a better cooperation between the Agency for R&D of Industry and its R&D institution with the synthetic fibre manufacturers. Consequently the kinds of fibre consumed will include the modified fibre which is suitable for their end uses in the tropical climate.

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R E F E R E N C E S

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POLYESTER INDUSTRY IN EGYPT*

prepared by

Abdel Meguid Youssef El Shazly**

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** Misr Rayon Co., Kafr El-Dawar - A.R.E., Egypt.

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About 5 years ago Misr Rayon commenced its first polyester plant for staple fibre. The plant consists of: 2 units for producing PET cotton type 1.4 denier with 36 tons per day capacity for each. The type produced is T 110 Rhone Poulenc Textile and one unit of woolen type T900 of the same company producing 12 ton /day.

T110 developped about 15 years ago is characterised by

- a high tenacity, 54 cN/tex (5.5 g/tex), which enables:
  . high spinning efficiencies to be obtained.
  . previously unreachable spinning limits to be achieved: e.g. using a 1.6 dtex staple fibre it is possible to spin as fine as 5.6 tex (180 nm) with a blend of 67% polyester and 33% cellulosic.
- a strength/elongation curve very similar to that of natural and man-made cellulosic fibres, thereby improving spinning and weaving efficiencies.
- a low shrinkage rate :

  3 to 4 % in saturated steam at 130°C
  4.5 % in dry air at 150 °C

  specially adapted for dyeing on cross wound cheese of 100% polyester or blended yarns.

The characteristics of the R.P.T. type T 110 polyester fibres makes them particularly suitable for a wide range of woven fabrics either in 100% form or blended with cellulosics; this range includes the lightest of voile type articles for lingerie and shirtings and heavier fabrics such as drapery for shirtings, trouserings, over coats etc.

The type T110 fibre is available in semi-dull and bright. we can tabulate these characteristics as follows: for short staple equipment

T 110 semi-dull

- Tenacity 53-56 CN/tex - extension at rupture 20-25% shrinkage in water at 100 °C 1.5% - Shrinkage in steam at 130°C 3-4 %
- Spinning process: conventional - open-end
- End use: woven fabrics
- Usual processing: 100% or blended with all cellulosic fibres
- Industrial spinning limits: 1.6 dtex 32 & 40mm

	conventional	open-end
100% polyester	8.3 tex (Nm 120)	13.3 tex (Nm 75)
Polyester blended with Cellulosic fibres:		
combed cotton	8.3 tex (Nm 120)	14.3 tex (Nm 70)
carded cotton	10.0 tex (Nm 100)	20.0 tex (Nm 50)
Man-made 1.6 dtex/40 mm	9.1 tex (Nm 110)	14.3 tex (Nm 70)

- Main applications: Solid and printed dress fabrics Weft velvet clothing, shirts, pyjamas-lingerie - rainwear, anoraks - work wear - linings - sheetings - Table linen - furnishings - curtainings - technical uses.
- Advantages and disadvantages: High tenacity and low extension, giving: higher spinnability - high strength characteristics in the yarn. Low shrinkage giving: possibility to yarn dye without pre-shrinkage. For clothing and furnishing, singeing, brushing and shearing are necessary.

The fibres were crimped to have the necessary cohesion, treated with finishes to have the necessary antistatic properties and the optimum degree of fibre-fibre, fibre-metal dynamic and static friction.

T 900 is a low pill polyester fibres characterised by a reduced transverse resistance which facilitates the breaking (due to rubbing) of the surface fibrils in the yarn, leading therefore to the elimination of pilling.

The general characteristics of this type for long staple equipment are as follows:

- Characteristics: tenacity 27-29 cN/tex. Extension at rupture 37-40%. Shrinkage in water at 100°C 2%. Shrinkage in steam at 130 °C 3.5%
- Spinning process: stretch breaking (1)
  converting) (2)
  wool-worsted)
- End use: woven and knitted fabrics
- Usual processing: 100% or blended with wool, cellulosic fibres or synthetics.
- Industrial spinning limits

			Fiber number in dtex 3.3	4.4	6.7
. 100% polyester					
Polyester blended with	45% wool	(1)	22.2 tex (Nm 45)	26.8 tex (Nm38)	33.3 tex (Nm30)
		(2)	25.0 tex (Nm40)	29.4 tex 5Nm34)	38.5 tex (Nm26)
	33% Cellulosics	(1)	18.2 tex (Nm55)	21.7 tex (Nm46)	31.3 tex (Nm32)
		(2)	20.0 tex (Nm50)	23.8 tex (Nm42)	36.7 tex (Nm28)

- Main applications: Drapperie - wool type fabrics - Dresswear and pleated shirts - stretch articles or blended with textured yarn-circular knitted fabrics - curtaining (solid and printed)
- Advatages and disadvantages: Flax-abrasion index particularly adapted for woven fabrics - less processing (no singeing) - fancy weaves and less structured weaves - softer handles - good dye affinity - lower tenacity requiring some precautions during the various stages of processing.

Misr rayon has now lines for producing chips for POY manufacturing and new development for producing higher deniers to satisfy market requirements for carpet industry. Misr Rayon has another factory for POY production and textured yarns with capacity reaching 12 tons /day.

Now, there is a feasibility study for another fibre plant with double capacity of the first plant to satisfy the textile mills demands in Egypt for polyester fibre.

The question is MDT origin or TA origin
The 2nd question is continuous or batchy process.
The major advantages of pure TA as a feedstock are :

1- Less TA than DMT is required to produce polymer. The price of DMT and pure TA are approximately the same.
2- Theesterification operates nearer the theoritical molar ratio reducing the load of glycol for recovery.
3- Capital cost of polymer plant is lower.
4- Consistent quality is easier to achieve
5- Reaction rate of monomer produced from TA is higher than that from DMT.
6- No methanol handling and recovery is required.
7- No ester interchange catalyst is required.
8- TA is a simpler solid to handle than DMT

The advantage of CP Process

1-Eliminates variation: Batch to batch - through the batch
2- Less dependance on operators (eg. esterifier transfer, additive and casting)
3- Direct spin capacity - initially or subsequently (eliminate casting, blending and drying costs)

4- Lower capital cost for large plants.
5- Less additives required - Potential higher quality

Advantage pf Batch Polymer Process

1- Lower capital cost
   Up to 40 t/day via direct spin
   Up to 80 t/day via continuous chip
2- Easier to recover after service/power failure or mal-operation
3- Easier to clean if quality drifts.
4- Easier to change formulation (TiO_2IV)
5- Can be run in campaigns for type and output fluctuations
6- Can be expanded more cheaply and in smaller steps
7- Easy to change from DMT to TA and vice-versa

Batch Process May be more suitable to the condition of the third world with the following features :

1- Capable of most stringent polymer quality
2- Optimised polymerisation conditions.
3- Advanced overhead design - free from blockage
4- Optimised additive preparation.
5- Production from pure TA or DMT.

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MAN-MADE FIBRE INDUSTRY IN PAKISTAN*

Prepared by

M.H.Chaudhry**

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** Federal Chemical and Ceramics Corporation Limited, Karachi - Pakistan

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BACKGROUND

The synthetic fibre development began in 1846, with the discovery by Friedrich Schonbein that cellulosic materials could be modified into materials with different properties, when treated with nitric acid. Nitrocellulose was the first man-made fibre and in 1890 the first artificial silk factory was built at Besancon in France to produce "Chardonnet Silk", following the successful experiment by Count Hilarie de Chardonnet in 1878. This first commercial production of artificial fibre became the fore-runner of the modern synthetic fibre industry.

Although nitrocellulose, which is a highly inflameable material, never achieved large scale usage, its discovery led to the development of viscose rayon. After the work of C.F. Cross, E.J. Evan and C. Beadle in England, an English company Courtaulds Limited established in 1904, the first large-scale manufacturing unit for the production of viscose rayon.

For nearly half of a century viscose rayon remained the primary man-made fibre. It is however not a purely synthetic material and the real beginning of the synthetic fibre industry was made with the production of the first 100% synthetic fibre "Nylon", by E.I. du Pont de Nemours and Co., in the United States, based on work of the company research team, led brilliantly by an organic chemist, Wallace H. Carothers.

In 1941, J.T. Dickson and J.R. Whinfield of Calico Printers Association in England first discovered polyester fibre. Polyester fibre, which was produced under licence by ICI Ltd., in U.K., and E.I. du Pont de Nemours in the U.S.A., soon after the 2nd World War, has become the pre-eminent synthetic fibre in the textile industry.

Many other synthetic fibres, including polyacrylonitrile and polyvinyl-chloride have been developed since then, however, polyester fibre has continued to be the most important synthetic fibre and has created a new field of textile due to its fibre blending potential.

In Pakistan, synthetic fibre industry was rather late in developing, since the local textile industry was originally based on home-grown cotton. Pakistan is one of the major cotton growing countries in the world. Cotton together with its processing industry and export of yarns and fabrics makes cotton textile industry the single most important sector of the national economy. Cotton textiles account for about a quarter of the value added in the manufacturing sector and contribute to about 41% of total export earnings. Most of the yarn manufacturers in Pakistan produce 100% cotton yarn in the main and switch over to synthetic fibres only when availability of cotton becomes limited or its price increases to a point, where its use become less economical than synthetics. In the recent years however, use of synthetic fibres has grown steadily and over 70,000 tons per annum of synthetic fibres are used in Pakistan.

SYNTHETIC FIBRE INDUSTRY IN PAKISTAN

Synthetic Fibre industry in Pakistan began in 1964, when the first acetate

rayon filament plant went into operation. Thereafter a number of very small nylon filament yarn plants were set up, but as in the case of acetate yarn, nylon never made real in-roads into Pakistan's textile industry. First entry of polyester was also in the form of filament yarn produced in large on the converted nylon plants, using imported polyester chips. However, by early 1970s polyester filament yarn and later staple fibre became the dominant synthetic fibre in Pakistan. With this in view, plans for setting up both polyester filament yarn and polyester staple fibres were taken up in earnest and in 1982 the country's largest and the first integrated plant producing both staple fibre and filament yarn using basic raw materials, became operational. The plant, National Fibres Limited, a company operated by the state-owned Federal Chemical & Ceramics Corporation Limited, has the capacity to produce 12,000 tons per annum of staple fibre and 3,000 tons per annum of draw texturized filament yarn. In addition the plant has a capacity to produce 18,000 tpa of polyester chips, which not only fulfills the plant's own demand, but leave sufficient surplus for sale to other polyester fibre manufacturers. In 1983 another polyester staple fibre plant also with a capacity of 12,000 tpa was set up by ICI. In the meantime, several smaller filament yarn plants were installed, the total installed capacity is around 14,000 tpa. Plans for more filament yarn and staple fibre plants have already received Government permission, will soon become operational, making Pakistan self-sufficient in its requirements for polyester fibre.

USE OF POLYESTER-VISCOSE BLENDS IN PAKISTAN

While the use of polyester fibre in Pakistan has continued to grow, a rather paradoxical situation has risen in the country's textile sector. Pakistan is one of the major cotton-growing countries in the world and it would be expected that the most important segment of textile industry

would be of polyester-cotton blended fabric, the actual situation is the reverse of this and there is hardly any cotton-polyester blends being produced in Pakistan. On the other hand there is a great deal of production of polyester-viscose rayon blends, which is to the determent of the local economy, since there is no production of viscose rayon in Pakistan and its total requirement has to be imported.

The reasons for the use of polyester-viscose blends at the expense of polyester-cotton blends in Pakistan is not very hard to find. Polyester--viscose blended yarns are far easier to produce and a mill owner is able to make a convenient product in polyester-viscose at a cost lower than a polyester-cotton blend in a 65/35 ratio at the current prices of raw materials, taking into account the cotton waste losses at blowroom, carding and combing operation and a 25% lower through-put at ring spinning caused by lower spindle speeds and higher twist multipliers for polyester cotton blends. Moreover, the majority of textile mills in Pakistan do not have the machinery for combing of cotton, which is an essential process for polyester cotton blended yarn. Another advantage of producing polyester viscose blends is the ease of manufacture and strict control of parameters, which is possible with the machine made viscose fibre.

This situation is likely to continue as long as Pakistan's textile industry is dominated by spinners, rather than weavers and end-users. I would like to mention here that in Pakistan the textile industry has fragmented itself into a handful of state-of-art integrated mills, spinning units (the so-called textile mills) and an enormous number of small establishments, with about 20 looms each, who weave about 85% of the total cloth produced. In the virtual absence of integrated mills and specialised weaving units, the spinners will continue to have his way, since small weavers have little say in choice of yarns and is happy to use whatever

raw-material is offered to him at the lowest cost.

This is unfortunate, because not only the country is spending foreign exchange in importing viscose rayon, rather than using home-grown cotton but the consumer is burdened with an inferior product. As is well known polyester viscose blended fabrics cannot match with polyester cotton fabrics as personal wear apparels in comfort. Even in the European countries where cotton is not grown, large quantities of cotton are imported for producing polyester-cotton garments and viscose which is locally produced is not used as the cheap and inferior substitute. Viscose has many of the attributes that the cotton fibre has, but due to the orientation of the viscose, combined with the absorption properties of the viscose fibre, the wet strength is reduced, whereas in cotton, the wet strength is increased with absorption of moisture. Viscose fibres can loose upto half its strength when wet and is therefore more easily stretched, this affects the dimensional stability of the garment during washing. Polyester-cotton garments, therefore has far superior dimension stability as compared to polyester-viscose blends.

Another important factor which makes polyester viscose fabrics inferior to polyester-cotton blends is viscose rayon's ability to 13% moisture, as against 7% of cotton. The time of retention of moisture in the viscose blended garments is greater than in cotton and in humid climates the viscose blends tend to feel clammy against the skin. Moreover, polyester-cotton garments have a more natural finished fibre appearance, which polyester-viscose fabrics have a finish that looks artificial. Polyester-viscose fabrics are also more prone to the pilling effect, when small pills are formed on the fabric when rubbing against other garments take place.

REASONS FOR THE USE OF POLYESTER VISCOSE BLEND

Despite all these disadvantages, polyester-viscose fabrics continue to dominate the blended fabric market in Pakistan. The reason for this is the fact that not many consumers know the difference between polyester-viscose garments which are passed on to customers as polyester--cotton fabrics. Since labelling of garments, giving details of fibres used is not mandatory in Pakistan, a customer has no way of finding the truth. During a marketing survey carried out, this fact was brought to light as most of the consumers buying polyester-viscose garments thought these to be polyester-cotton blends. The users did complain of the pilling problem, the reduced life of the fabrics and the uncomfortable feeling in wearing this garments. However, the consumers put these defects down to "inferior" production by local manufacturers, compared with "superior" garments they had purchased from foreign suppliers. They were totally unaware that they were actually comparing locally produced polyester-viscose blends with imported polyester cotton blends and that the lower quality of local products was not due to poor workmanship but due to the use of inferior blends.

In Pakistan, an isolated polyester-viscose fabric market has been created where the consumer does have a choice of fabric quality. This artificial market has been created by the spinning mills, for whom it is profitable to produce polyester viscose blends. The spinners who are controlling the market, dictating the down stream products, have no qualms about passing an inferior product on to the consumers, as long as it is profitable to them, the spinners.

STEPS FOR ESTABLISHING POLYESTER-COTTON BLENDS IN PAKISTAN

There is thus a need to enlighten the consumers and to protect their

needs, as in the developed countries so that an independent choice of fabric could be made even through trial and error, when readymade garments carry identification labels of fabric quality and blend ratios. It is only through consumer awareness that the domination of spinning mills in determining the choice of blended fabric will end.

We, as the major polyester fibre producers in Pakistan, are making strenous efforts to provide the Pakistan consumers with the best product at the most economical prices. To achieve this aim we are bringing to the notice of our Government a number of anamolies which have loaded the dice in favour of spinning mills and to the proliferation of polyester-viscose blends, which is of course to the deteriment to the consumer. Production of polyester-viscose blends require imports of about 20,000 tons per annum of viscose staple fibre at a foreign exchange expenditure of about Rs.400 million per annum. Which, in view of the many disadvantages listed above of manufacturing viscose blends in Pakistan, is a wastage of foreign exchange. Manufacture of polyester--cotton blends has to be encouraged at the cost of polyester-viscose blends, as there is sufficient availability of Pakistan cotton in 27.5 mm staple length and above, which is suitable for blending with polyester, to make good quality shirts, sheets, pillow cases, curtains and ladies summer-wear dress materials. Since there is no export market for polyester-viscose blended fabrics, the export potential of the local textile industry is hampered to a large extent and is limited only to 100% cotton products. With the production of polyester cotton blends a whole new export market for blended fabrics will be opened for the country's textile industry. A number of neighbouring countries like India have large export markets for their polyester cotton blended fabrics.

A national policy has to be developed to establish the polyester cotton market. The spinners should be made to take responsibility of the quality

of yarn produced. not in terms strength and length of yarn for the cloth manufacturer, but in terms of overall fabric quality. The expansion of the textile industry should be to include weaving, dyeing and finishing departments for the large number of independent spinning mills in the country and not merely to expand the spinning capacity in the same mill or to establish more individual spinning units.

Such programme of development will result in :-

1. The production of fabrics more suitable for the Pakistan market.

2. The stimulated growth of the cotton agricultural system.

3. Creating a more quality conscious market in cotton-polyester yarns and fabrics for domestic and export purposes.

4. Creating an enormous saving in foreign exchange with the absence of viscose.

5. Creating a possible export market with foreign exchange earnings.

6. Creating a more stable market that will import the textile industry as a whole.

7. Providing more jobs with profitable growth of the textile industry in Pakistan.

It is encouraging that the Government has begun to respond to our efforts and we hope that the existing anamolous situation in the blended fabric market will soon be rectified.

SYNTHETIC FIBRES TECHNOLOGY CENTRE

While the immediate problem of the synthetic fibre industry in Pakistan have been identified and efforts are being made to improve the situation. There is still a need to improve the over-all quality of synthetic fibres and to provide industry oriented application activity to improve the synthetic fibre industry in Pakistan.

With this end in view, Federal Cheical & Ceramics Corporation Limited, in collaboration with UNIDO/UNDP, is planning to set up a synthetic fibre technology Centre under the name of Synthetic Fibre Development and Application Department (SFDAD) at Karachi. It is hoped the proposed Centre, which is likely to be established by January 1987, will provide substantial and meaningful help to the synthetic fibre industry in Pakistan.

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THE SITUATION OF THE MAN-MADE FIBRE INDUSTRY IN THAILAND*

prepared by

Manus Earthayapan**

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** Thailand Institute of Scientific and Technological Research

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Introduction

Textiles have played a very important role in the industrialisation of Thailand. The industry's growth has been very high since the start of investment promotion for industrial development about 25 years ago. During the first 10 years textile production was concentrated in cotton fabrics and spinning, then man-made fabrics and spinning. In 1968 the production of man-made fibre started. Since 1973 there has been the promotion of textile for export.

The textile industry in Thailand at present includes both natural and man-made fibres and fabrics, For natural fibres and fabrics, cotton is the basic material accounting for most of the production. Man-made fibres are polyester staple polyester filament . nylon filament and rayon staple. The development of the synthetic fibre industry has been in stages. First the small scale nylon filament production company was established under the joint venture with Japanese capital, technology and experties during 1963-1966 . The second expansion period was 1967-1975 when many more large mills come into existence and the established mills increased their production capacity. The production of polyester fibre was begun with the establishmer of Teijin polyester (Thailand)(1967-1970)and Thai melon polyester Co,Ltd.(1975) The nylon filament production was begun by Asia Fibre (1970) and Toray nylon Thai Co. The viscose rayon staple fibre was started by Thai Rayon Co. (1974) .

Production

Table 1 shows the detail quantity of textile production during 1983- 1984 . The capacity of synthetic fibre production in 1984 was 115,160 metrictons or 4.2 per cent higher than the capacity in 1983. Table 2 shows more detail quantity of synthetic fibre production during 1983-1984. The increasing fibre capacity was polyester staple fibre and viscos rayon,,while the polyester filament yarn and nylon filament was decreasing by about 3 per cent .

The Demand for Man-made Fibre Products

The demand of Textile product is increasing each year because of the growing number of population and the increasing of export market. Table 3 shows the consumption of yarn and fabrics during 1973 - 1982. The apparent consumption of cotton and synthetic fibres have increased annaully by 8 and 25 percent respectively on the average. Since the rate of population growth has been much lower, the per capita consumption of fabric has been raising very high.

The overall development in the foreign trade of textile may be summerized as follows in 1960's all categories of textile products were imported. Imports of cotton fabrics and yarn started tobe substituted by domestic production, followed by the substution of imports of man-made yarn and fabrics. In the early 1970's, the production of cotton and man-made fibre were accelerated, while cotton and man-made fabric and cotton yarn mostly gray goods, started to be exported. The major export market are member of European community, followed by U.S. and Middle East countries. The breakdown as follows:

Countries	man-made fibres yarn (ton)	gray fabric (1000 sq.yd.)	garments (1000 pcs.)
EEC.	2,293	205,420	35,888
U.S.A.	2,720	76,798	68,940
Middle East	8	14,403	45,653
Japan	329	41,817	1,094
Other	21,878	167,770	57,908
Total	27,228	506,208	209,483

Source Base on value of exports from Customs Department.

Problem in textile industries

The problem may be grouped in to three areas: export market, cost of production and technological limitation.

Most firm complained about the limitation and inflexibility of the export quota given to them. With high transportation cost and high cost of production, it is difficult for them to compete in the world market.

The high cost of production is resulting from high prices of raw materials, and high cost of public utilities and wages.

The technological limitation has prevented the industry to move up to a higher quality and a higher value added textiles. This has been due to the policies of foreign companies in selling technology to Thailand.

Prospects

The man-made fibre industry in Thailand has for the last few years experienced considerable problems including increasing cost, export quota restrictions and uncertainty reguarding goverment policies. All parties concerned appear to have recognized the need for a restructuring of this industrial sub-sector and efforts are at present being made by Goverment, industry associations, to solve the short and medium term problem. However for long term projection for the textile and man-made fibre industries, the trends in the production of textile and man-made fabrics, will gradually become more dependent of the domestic market than the export markets.

Table 1 Textile production 1983 - 1984

Type of Textile	Number of machine in use 1984	production 1983	production 1984	production change %
mam-made fibre (metricton)	n.a.	110,482	115,160	4.2
cotton yarn (metricton)	1,649,258	237,947	250,000	5.1
woven fabric (1000 sq.yd.)	70,165	1,739,472	1,835,150	5.5
knitting fabric (1000sq.yd.)	42,942	463,406	495,840	7.0
Garment (million pieces)	n.a.	170	210	23.5

Source The Thai Textile Manufacturing Association

Table 2 Man-made fibre production 1983-1984

type of man-made fibre	capacity per month 1984	production 1983	production 1984	product chang %
Polyester Staple Fibre	5,200	53,866	57,323	6.4
Polyester filament yarn	2,010	17,757	17,386	-2.1
Nylon filament Yarn	1,560	17,060	16,413	-3.8
Viscose Rayon yarn	1,500	17,451	18,871	8.1
Pre Oriented yarn	400	4,348	5,167	18.8
	11,570	110,482	115,160	4.2

Source : Information from the companies

TABLE 3 THAILAND'S PRODUCTION, CONSUMPTION, IMPORTS AND EXPORTS OF YARN & FABRICS

(Thousands of Tonnes)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Cotton Yarn :										
Production	67.0	66.9	70.5	73.0	94.2	83.3	96.4	96.2	97.3	101.2
Consumption	64.3	63.7	68.5	96.2	84.8	88.9	92.5	96.2	100.9	107.6
Imports	1.2	0.3	0.3	0.1	-	-	0.3	0.4	0.9	0.3
Exports	1.2	0.1	-	0.9	2.9	2.6	0.8	0.8	0.5	1.8
Man-Made Yarn :										
Production	47.1	47.5	61.6	75.3	91.5	115.3	122.6	127.3	132.9	132.2
Consumption	53.5	50.0	62.7	72.8	78.5	94.5	103.3	109.5	120.4	132.1
Imports	12.9	10.0	3.3	5.8	3.4	4.0	6.2	5.2	7.9	7.7
Exports	3.5	2.5	3.1	11.0	14.6	19.2	14.8	22.2	20.4	14.7
Cotton Fabrics :										
Production	572	566	605	679	745	779	807	839	872	936
Consumption	456	490	501	533	558	594	626	634	690	713
Imports	44	38	26	15	20	19	15	20	18	18
Exports	69	32	49	123	121	120	110	112	96	162
Man-Made Fabrics :										
Production	272	392	522	660	696	851	929	984	1,129	1,147
Consumption	280	320	375	385	425	462	505	607	627	653
Imports	50	51	41	33	40	64	61	101	95	77
Exports	75	51	67	140	160	277	288	213	293	303

Source : Thai Textile Manufacturers Association.,
Department of Customs

Table 6 Name of Synthetic fibre Companies.

No.	Name of Companies	Production and Type (Ton/year)	Year of establishe
1	Toray Nyton (Thai) Co,Ltd.	Polyester, filament yarn 7200 Nylon, filament yarn 5400	1967
2	Teijin palyester Co,Ltd.	Polyester filament yarn 14;400 Polyester staple yarn 31200	1970
3	Asia fibre Co,Ltd.	Nylon filament yarn 5400	1972
4	Thai Melon Polyester Co,Ltd.	Polyester filament yarn 7200 Polyester staple yarn 18,000	1976
5	Oriental fibre Co,Ltd.	Polyester filament yarn 2,400	1977
6	Capital Twist textile Co,Ltd.	Nylon, yarn 4,320	1973

Source : Board of Investment.

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A REVIEW OF THE DEVELOPMENT OF MAN-MADE FIBRE PRODUCTION IN IRAN*

Prepared by

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Abstract:

In the present article the development of Synthetic Fibre Production in Iran has been reviewed. The appearance and transfer of this technology, production of synthetic fibre, also table and statistics whenever necessary are included.

The consumption of artificial fibres in Iran

Staple viscose rayon was the first artificial fibre used in Iran in 1964. Other synthetic fibres, nylon, polyester and then acrylic came to market and used one after another.

In the last decade there was always a swift increase in the imports of artificial fibres, from which 2/3 are viscose rayon.

At present there are three synthetic fibre manufacturer in Iran, Aliaf, Polyacryl and Parsilon which are discussed below:

The Aliaf Company of Iran

The Aliaf company is the first producer of synthetic fibres in Iran, established in 1966. This company produces nylon 6 from Caprolactam. Aliaf was a shared investment of 900 million Rials (130 million U.S.D in 1966), which 50% of the total investment belonged to American Allied Chemicals and 50% from private sectors.

The production was started in 1969 with the capacity of 4500 tons/year, nylon 6 in the first phase.

Allied company sold his share to Bayer (German Company) in 1970.

Aliaf company was expanded in 1973 and the production (table 1,2) reached to 10000 T/Y.

Although Aliaf was an American shared investment from the beginning but 90% of the machinery are Zimmer made.

At present the whole production of this company are consumed in Iran, and the necessary raw materials are mostly imported from Europe.

The total personel of the company are 1300 which work in three shifts.

Table one

The type of production of Aliaf company

		No. of yarn denier	No. of filaments
1	mat (UD)	20	1
2	Bright (B)	40	10
3	(B), cross. sec. Y shape	40	10
4	Black (BLK)	20	10
5	mat (UD)	70	20
6	mat (UD)	70	17
7	(B), cross. sec. Y shape	70	20
8	mat (UD)	100	24

Table Two

Production of Aliaf Company from 1970-1983

Year	10^3 Tons
1970	3
1971	4.5
1972	4.7
1973	5.9
1974	6.0
1975	6.3
1976	8.7
1977	8.5
1978	6.4
1979	7.0
1980	9.2
1981	9.7
1982	8.7
1983	6.5

The Polyacril Company of Iran

The Polyacril company was established in 1974 and the plant is located in a distance of 40 Km. south of Isfahan.

This is a shared company of American du-Pont, private and state sectors of Iran. The total investment so far are around 1000 000 000 U.S. Dollars.

The plant is one of the most modern ones, dependent to the American du-Pont. It produces both, polyester and acrilic fibres.

The present capacity of production is 53000 Tons/Year, as follows

Polyester	Filament	14000
Polyester	Staple	20000
Acrylic	Tops	19000
Total		53000

It has been designed to be expanded up to 80000 T/Y, in future.

The first production was polyester filament, came to the market in 1978 and polyester staple was produced in 1980.

The raw materials are imported mostly from Europe.

The total number of personel are 2600 which work in three shifts.

Table Three

The Possible Production of Polyacryl Co.

	Polymerisation Capacity Ton	Spinning Capacity Ton	Production		
			1981	1982	1983
PE filament	18000	14000	6602	6911	12800
PE staple	37200	20000	7990	7933	11500
AC staple	25400	19000	7670	5297	11000
AC tops	-----	-----	6607	6754	11800
Total	80600	53000	28869	26895	47100

The raw materials for polymerisation are imported and processed in the plant to produce polyester and acrylic fibres.

To produce acrylic tops, the required acrylic tow are imported and converted to tops. The production of tops are 12000 Tons/year.

Table Four

The Specification of the Production of Polyacryl Co.

A. Polyester, Filaments

Type	202 --	78	d. tex ,	34	Filaments
Type	202 --	110	d. tex ,	34	Filaments
Type	202 --	167	d. tex ,	34	Filaments
Type	312 --	135	d. tex ,	34	Filaments
Type	312 --	180	d. tex ,	34	Filaments
Type	312 --	280	d. tex ,	34	Filaments

B. Polyester, Staple

Type	532 --	1.6	d. tex ,	38mm.	/ Semi-mat.
Type	642 --	2.2	d. tex ,	38mm.	/ Semi-mat.
Type	642 --	3.3	d. tex ,	60mm.	/ Semi-mat.

C. Acrylic, Tops

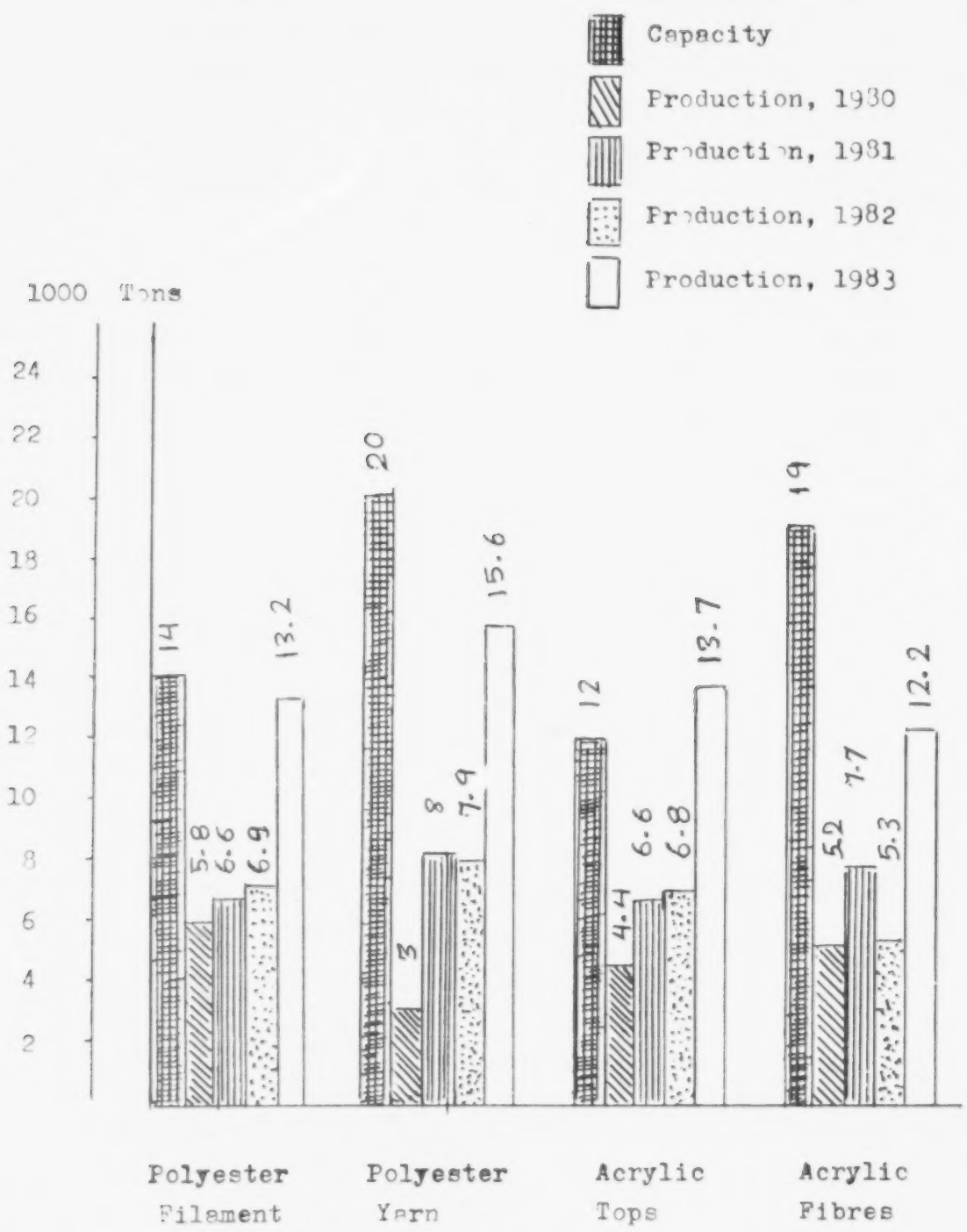
Type	162 --	3.3	d. tex ,	Semi-mat.	-- highbulk
Type	161 --	3.3	d. tex ,	Bright	-- highbulk
Type	161 --	5.0	d. tex ,	Bright	-- highbulk
Type	161 --	6.7	d. tex ,	Bright	-- highbulk
Type	141 --	3.3	d. tex ,	Bright	-- regular
Type	141 --	5.0	d. tex ,	Bright	-- regular

D. Acrylic, Staple

Type	102 --	3.3	d. tex ,	38mm. ,	Semi-mat.
Type	101 --	3.3	d. tex ,	60mm. ,	Bright
Type	101 --	5.0	d. tex ,	60mm. ,	Bright
Type	101 --	5.7	d. tex ,	60mm. ,	Bright
Type	101 --	5.3	d. tex ,	75mm. ,	Bright
Type	101 --	5.0	d. tex ,	75mm. ,	Bright
Type	101 --	6.7	d. tex ,	75mm. ,	Bright

Table Five

The Capacity and Production of Different Type of Fibres During 19



The Parsilon Company

The parsilon Co. was established in 1974 and the plant is located in Khoramabad in west center of Iran .

This was at the beginning a private investment of 245,000,000 Rials (35 000 000 U.S. Dollars). The plant has been made by Zimmer from Germany and all the machineries are from Zimmer.

The capacity of this firm is 8000 T/Y. nylon 6 yarn, in 20, 30, 40, 70 and 100 denier types in the first phase. Thereis programme to expand the plant and the capacity will reach to 16000 T/Y.

This firm has a texturizing section which has started the production from 1982.

The capacity of texturizing section is 1500 T/Y. and has 6 texturizing machines, having 1296 spindles. The machines are French made (SOTEXA).

The total number of the personels are 900,working in three shifts.

The Production of Texturized Yarn in Iran

SANCOR was the first texturizing unit, established in 1955. Now there are 8 texturizing units operating which produce nylon and polyester texturized yarn, table illustrates the statistics of these units.

Table six

The Texturizing Units

Name	Place	Biginning	No. of Spindles	Type of production	Production 1983 T/Y.
SANCOR	TEHRAN	1955	648	Nylon	8
MADAR	TEHRAN	1964	5184	Nylon	2740
STRETCH	ESFEHAN	1967	1080	PE/NY	726
PORSA	GHAZVIN	1973	9432	PE/NY	5406
IRAN KNITTING	GHAZVIN	1973	4320	PE	5132
FORTEX	GHOM	1974	4840	PE	1960
SHADILON	MASHHAD	1976	768	PE	1750
PARSILON	KHORAM-ABAD	1974	1296	NY	345
			27568 total		18067 total